### 5. HEALTH AND SAFETY REQUIREMENTS

A health and safety plan is not required for this project. Instead, per the requirements of INEEL MCP-3562, a hazard screening checklist was completed for this characterization activity to identify all hazards associated with this project. Hazards identified on the checklist, along with corresponding mitigation requirements are documented on a JSA per MCP-3450, "Developing and Using JSAs." In completing the JSA, technical input and approval is obtained by assigned ESH&QA personnel. The JSA identifies all potential hazards associated with this project.

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# Appendix A Sampling and Analysis Plan Tables

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

Pran Table Number: LTS ECM 2003

Plan Table Revision: 0.0 SAP Number Date: 01/28/2003

Project: LONG-TERM ECOLOGICAL MONITORING FY-03

Project Manager HANEY, T JJVANHORN, R.L.

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SMD Contact MCGREFF, T. W.

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Project Manager. HANEY, T. J.VANINDRN, R. L. DRAFT

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ECR058	REG	SOIL	GR48	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	DEL	-									-					
ECR059	REG	3017	GRAB	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	180	-			-	_		_	_		$\vdash$	_				
ECR060	REG	NOS	GRAB	divoc	05/01/03	INEEL	SOIL	REFERENCE AREA	TBD	-			-				<u> </u>			_				
The sampling	g activity displaye	The sampling activity displayed on this table represents the first six characters of the sample identification number	he first six ch	naracters of t	he sample identi	fication number.	The complete sample identification	The complete sample identification number (10 characters) will appear on field guidance forms and sample labels	r on field guidance forms	es jue	ege lage	. نور	┨		1	┨	-	1	ł	-	1	1		]
AT1: Analysis Suite #1	ysis Suite #1						AT11:				1	Comments	ig:					1						
AT? Gatt	Carthworm Toxicity Test	est.					AT12:				}	Lathwi	<u>6</u>	ž.	Earthworm Toxicity Test by ASTM standard E1676-97	M stand	ard E16	5						1
AT3: Nitros	Nitroaromatics (8330)						AT13					Rye Gr	ass Tes	t by AS	Rye Grass Test by ASTM standard E-1598-94 Septing Growth Test	and E-15	98.94 S	eeding	Growth	Test				
AT4: Radio	Radiochemistry - Suite	‡ a					ATM:															$\  \ $		
ATS: Rye (	Rye Grass Growth Test	Ş.					AT15:					The	L for ga	ds euu	The TAL for gamma spec shall include standard list plus K.40	ndudes	tandard	list plus	3					ı
AT6: Total	Total Metals (TAL)						AT16					Niroard	Matics	TAL sha	Niroaromatics TAL shall include TMT, RDX, HMX, 2.4 dinitosolvene, 2.6 dinitosolvene,	TMT.	DX, HM	X 2.4d	initrotolu	Jene, 2.6	-dimetot	bluene		I
AT7:							AT17.					2-amin	P 8-6	itrotolu	2-amino-4,5-dinipotoluene, 4-amino,2,6-dinipotoluene	ano 2.6	diniboto	e Green						
AT8.							AT18						'					-				ĺ	-	
AT9.							AT19					Stw. Ras	etals :	Total Metals (TAL) shall SW-846 method 60108	l trial Metalis († 14.) strait include arsenut, beryllium, cacmium, chromium, lead, mercum, zind by SW: 865 methyd 60108	SESPIC.	n kan	F 690	E E	EQMINE.	E G	al Circ	a Co	
AT10:							AT20:																	1
Analysis Suites	Say							Contingencies:																i
Analysis Sur Radiochemic	te #1: Mosture C	Analysis Sute #1: Mosture Content, Hydrogen Ion (pH), Cation Exchange Capacity, Radiopernistra, Suids 1: Am. 341 Camma Star, Bulley 11:les - 6: 00	Cation Exch	lange Capac	Ž.																			ı
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Project Manager: HANEY, T. J.WANHORN, R. L.

SMO Contact MCGRIFF, T. W.

														3						١,			
	J.	Sample Description					Sample	Sample Location		$\vdash$	Ε					- Land			-	,	$\vdash$	H	
Sampling	Sample	Sample	8	Sampling	Planned		Type of		Depth	AT1 AT2	AT3	AT4 AT5	5 AT6	AT7	AT8 AT9 AT10 AT11 AT12 AT13 AT14 AT15 AT16 AT18 AT19 AT20	AT10 AT.	11.AT12	AT13	<u> </u>	S AT 18	AT17A	18 AT19	PAT20
Activity	Туре	Matrix	Type	Method	Date	Area	Location	Location		35	Ž	RH 33	۲										
ECR061	REGIOC	SOIL	DUP	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	TBO	2 2						-			-		┢	<u> </u>	
ECR062	REG	SOIL	GRAB	COMP	05/01/03	NEEL	SOIL	REFERENCE AREA	180	-						_						-	
ECR063	REG	SOIL	GRAB	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	180	-						•							
ECR064	) BEG	TIOS	GRAB	COMP	05/01/03	INEEL	TIOS	REFERENCE AREA	0 <u>8</u> T	-												L	
ECR065	REC	1105	GRAB	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	TBD	-											<del> </del>		
ECR066	REG	SOIL	GRAB	СОМР	05/01/03	INEEL	TIOS	REFERENCE AREA	180	-		$\vdash$				_							
ECR067	REG	SOIL	GRAB	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	OB1	-		<del> </del>		<u> </u>	Ë								
ECR068	REG	1IOS	GRAB	COMP	05/01/03	INEEL	SOF	REFERENCE AREA	081	-				<del> </del>	_							ļ	
ECR069	REG	1IOS	GRAB	COMP	05/01/03	INEEL	SOIL	REFERENCE AREA	98	-		_				-			_				
ECR070	REG	110\$	avas	dMOD	05/01/03	INEEL	SOIL	REFERENCE AREA	180	-						-			ļ				
ECT001	REG	ATOIS JAMINA	8449	COMP	05/01/03	INEEL	DEER MOUSE	TRA	NA			-	-										
ECT 002	REG	ANIMAL BIOTA	BARO	COMP	05/01/03	INEEL	DEER MOUSE	TRA	Ą	_		-	-								_	-	
ECTOD3	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEEL	DEER MOUSE	TRA	Ą.	<u> </u>		-	-						┞		┨	-	
ECTODA	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEEL	DEER MOUSE	TRA	ą.	_			-										
ECTODS	REG	ANIMAL BIOTA	BVHO	COMP	05/01/03	INEEL	OEER MOUSE	TRA	ž			<b>-</b> -	-	<del>                                     </del>							$\vdash$		
The sampling	activity displayed	The sampling activity displayed on this table represents the first six characters of the sample idea	he first six ch	aracters of th	e sample identii	tification number.	The complete sample identification	The complete sample identification number (10 characters) will appear on field guidance forms and sample labels	on field guidance forms .	and sam	ple labels		] ,	1	1				$\left\{ \right.$			-	]
	Analysis Suite #1						AT11:					Sadhwarn	a Tenicib	Taktby	Comments. Earthworm Toxicity Text by ASTM standard E1676.07	andard F1	676.97						
	Earthworm Toxicity Tasi						A112				, . 		200	B	20		i i						1
AT3: Nitroan	Niboaromatics (8330)						AT13.		1		-1	Rye Grass	S Test by	ASTM	Rye Grass Test by ASTM standard E-1598-94 Seeding Growth Test	1598-94	Seeding	Gowth	Test				١
AT4 Radioc	Radiochemistry - Suite 1						AT14.										١	ı					١
ATS. Rye Gr	Rye Grass Growth Test						AT15					The TAL 6	or garnin	Pa spec	The TAL for genima specishall include standard list plus K-40	e standan	d list plu	S K-40					ı
AT6. Total M	Total Metals (FAL)						A116.				-	Niboarom	alics TA	Lebatin	Nitroaromatics TAL shall include TMT, RDX, HMX, 2.4-dinitrotaluene, 2.6-dinitrotaluene	ROX, HA	WX, 2.4-c	dinitrotal	uene, 2,6	3-dinitrote	otherne.		ı
ATT							AT17:				*(	2-ammo-4	6-dinitr	ptolynene,	2-arring-4.5-dinitrotoluene, 4-arrino,2.6-dinitrotoluene	2.6-dinitrol	toluene						1 1
ATB.							AT18:				,,		Į.			1							1
AT9:							AT19:				, <b>.</b>	SW-845 method 6010B	altor 6	110B	i olga Metas (i i At, shall indude argenc, benyilium, cadmium, chromium, ead, mercury, zinc by SW-848 method 60108	nc, beryll:	E Cad	E E	E E	E 30	HCUPY. ZI	ž.	1
AT10:							AT20:																1 1
Analysis Suries	и							Contingencies:															
Analysis Suite	#1 Moisture Cor	Analysis Suite #1 Mossure Content, Hydrogen Ion (pH), Canon Exchange Capacity	Cathon Exch	ange Capaci	4						100												ŀ
Kadvocnemsi	ny - Surte 1: Am-2	Kadrochemisty - Suite 1: Arr-241, Gamma Spec, Pu-Iso, U-Iso, Sr-Au	. U-150, Sr-9																				1
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																							1.1
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Project Manager: HANEY, T. J.MANHORM, R. L. DRAFT

SMD Contact: MCGRIFF, T. W.

																Ì	-		-	-			-
	V)	Sample Description					Sample Location	Location	_					Enter Ana	Enter Analysis Types (AT) and Quantity Requested	s (AT) and	d Quant	ty Reque	sted				_
Samples	Cantolia	Samela	3	o jeme	Page 1		10 000		4	ATI AT2	AT3	AT4 ATS	AT6	AT7 AT6 AT9 AT10 AT11 AT12 AT13 AT14 AT15 AT16 AT17 AT18 AT19AT20	1T9 AT10	AT11A	T12 AT1	3AT14,	AT15AT	16 AT 17	AT18	TISATZA	$\overline{}$
Activity	Type	Matrix	ž.	Method		Ves	Location	Location	£ (2)	я я	ž	#5 25	<b>5</b>							<u> </u>			_
ECT006	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEEL	DEER MOUSE	TRA	NA			-	-				┝		-	L		-	_
ECT007	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEBL	DEER MOUSE	TRA	NA			-	-				_						
ECT008	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEEL	DEER MOUSE	TRA	άN		_	-	-				_			L		┝	_
ECT009	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	INEEL	DEER MOUSE	TRA	A.A.			-	-	_	<u> </u>				-	_		-	_
ECT010	REG	ANIMAL BIOTA	GRAB	COMP	05/01/03	IMEEL	DEERMOUSE	TRA	ž			-	-	_	_		_	_					
ECT011	20/938	PLANT BIOTA	PUP	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	¥N.			2	2						-			-	
ECT012	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	NA			-	-							_		$\vdash$	•
EC1013	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	ТВА	∌			-	-				-			_		-	
ECT014	REG	PLANT BIOTA	GRAB	COMP	05:01/03	INGEL	SAGEBRUSH	TRA	¥			-	-				$\vdash$						_
ECT015	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	Ą			-	-				_		<del>                                     </del>				_
ECT016	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INCEL	SAGEBRUSH	TRA	¥.			_	-				_		<del> </del>	ļ_		<del> -</del> -	
ECT017	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	\$			_	-				-					-	
ECTD18	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	¥			_	-				ļ		$\vdash$				
ECT019	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SAGEBRUSH	TRA	ΨN			_	-				L					<u> </u>	
ECT020	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	SACEBRUSH	TRA	NA			-	-									├	
The sampling a	impling activity displayed in Analysis Suite #1	The camping abount displayed on this tacke represents the first six characters of the cample inconficution number ATT. Analyse Subsetf	the first six c	characters of	the sample iden	dification number.	The complete sample identification AT11:	The complete sample identification number (10 characters) wil appear on field guidance forms and sample labels, A11:	r on field guidance forms	mes pue s	ole labels.	s. Comments:					ł		ĺ		1	1	_
	Earthworm Toxicity Test						ATIS					Earthworm Toxicily Test by ASTM standard E1676-97	Toxicily T.	est by AST	M standar	dE1676	<u>6</u>						
	Nitroarometics (8330)	·					AT13:					Rve Grass Test by ASTM standard E-1598-94 Seedling Growth Test	est by A6	STM stand	ard E-1598	3-94 Seed	ding Gro	isa_ qu					
AT4: Radioc	Radiochemistry · Surte 1						A314				. , 												
ATS Rye Gr	Rye Grass Growth Test						ATIS					The TAL for gamme spec shall include standard list plus K-40	вшшеб	pec shall	nolude star	rdard list	plus K-4	ŝ				f	
ATE TOTAL M	Total Metals (TAL)						AT16.				-   	Nitroaromatics TAL shall include TNT, RDX, HMX, 24-dinitrobluene, 2.6-dinitrobluene,	CS TAL SI	hall inctude	TMT, RD	X, HMX, 2	24010	otoluene	2.5-dini	Totologn	ته		
AT7.							AT/7:					2-amino 4,6 dinitrolotuene, 4-amino 2,6-dinitrololuene	dinitrala	uene. 4-an	ino 2.6-dir	nitrololuei	96						
AT8:							AF18:				,   			1					3			I	
AT9							AT19:				.,., 	Total Metals (TAL) Shall include arserut, beryllurin, cadmurin, critorium, lead, melcury, zind by SW-846 method 60108	TO B 6010	ial include	Series Series	erylkum, o	Cadmun	CITORI	E G	mercun	202		
AT10:							AT20:				, , 												
Analysis Suries	ŧđ.							Contingencies:															
Analysis Surte Radiochemistry	#1: Moisture Co. y - Suite 1: Am-24	Analysis Surte #1: Moisture Content, Hydrogen Log (pH), Cation Exchange Capacity Radiochemistry - Suite 1: Am-241. Gamma Spec, Pu-iso, Luiso, Sr-90	, Cation Exc 3, U-Iso, Sr-5	hange Capa	<u>A</u>	F																	

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Project Manager: HANEY, T. J.MANHORN, R. L.

SMO Contact: MCGRIFF, E. W.

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	v.	Sample Description					Sample Location	.ocation	1	ŀ	ļ	-	Į	Enter A	Enter Analysis Types (AT) and Quantity Requested	pes (AT)	and Qua	antity Rec	paysand	ŀ	-	İ	$\neg$
Sampling	Sample	Sample	Col	Sampling	Planned		Type of			AT1 AT2	AT2 AT3 /	AT4 AT5	AT6	AT7 AT8	AT8 AT9 AT10 AT11 AT12 AT13 AT14 AT15 AT15 AT17 AT18 AT19 AT20	TD AT11	AT12A	tT13AT1	14 AT15	AT16A1	TI7 AT1	AT 19A	8
Activity	Туре	Matrix	Туре	Method	Date	Area	Location	Location	€	34 30	ž	RH 3S	5										
ECT021	REGIOC	PLANT BIOTA	DUP	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA			2	2										Γ
ECT022	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA			1	-							_			
ECT023	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA			+	Ξ										Γ
ECT024	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA	_		-	-								_		_
ECT025	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	¥¥			F	Ξ										
ECT028	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA.			-	=	_									П
ECT027	REG	PLANT BIOTA	GRAB	COMP	05/01/03	INEEL	CRESTED WHEATGR	TRA	NA			1	Ξ	H		-		-		┢	-		П
ECT028	REG	PLANT BIOTA	GRAB	dWOO	02/01/03	19314	CRESTED WHEATGR	TRA	A)			-	=			-		_		-			Γ
EC1029	998	PLANT BIOTA	GRAB	dRXOD	05/01/03	-WEEL	CRESTED WHEATGR	TRA	ΑΛ			+	-										Π
ECTO30	REG	PLANT BIOTA	GRAB	джоо	05/01/03	INEEL	CRESTED WHEATGR	TRA	Ą			-	-										Т
ECT031	REGIOC	103	900	COMP	05/01/03	INEEL	SURFACE SOIL	TRA	12	2		2	2	F		-		$\vdash$					1
ECT032	REG	SOIL	GRAB	COMP	05/01/03	INEEL	SURFACE SDIL	TRA	ΑN	-		-	-										1
ECT033	REG	SOIL	GRAB	амоо	05/01/03	INEEL	SURFACE SOIL	TRA	ΝN	-		-	-	<u> </u>		_		$\vdash$					Т
ECT034	REG	SOIL	GRAB	dwoo	05/01/03	INEEL	SURFACE SOIL	TRA	¥	-		_	-							_			1
ECT035	REG	SOIL	GRAB	dMOO	05/01/03	NEE!	SURFACE SOIL	TRA	N.	-		-	-										Γ
The sampling a	mpling activity displayed. Analysis Suite #1	The sampling activity displayed on this table represents the first aix characters of the sample identification number.	he first six ch	avacters of t	he sample ident	ification number.	The complete sample identification	The complete sample identification number (10 this actient) will appear on field guidance forms and sample labels.	r on field guidance forms	dues pue	ie labels.	Comments:								1	-		1
	Earthwerm Toxicuty Fest						AT12					arthwerm	OXICITY	Earthworm Toxicity Test by ASTM standard E1576-97	STM stan	lard E16	76-97						1
	Nitrogramatics (8330)						AT13:			-	"	ve Grass	189	Rve Grass Jest hy ASTM standard E. (588-94 Seedlinn Growth Test	dard F.	5.86.94	eedlin (	Smeth	128				1
AT4. Radiool	Radiochemistry - Suite 1						AT14.				1 I												
ATS: Rye Gr	Rye Grass Growth Test						AT15.					he TAL fo	r gammi	The TAL for gamma spec shall include standard list plus K-40	linclude	standard	st plus	8					
ATS: Total M	Total Metals (TAL)						AT16:				, z 	droaroma	Ses TAL	Nitoeromatics TAL shall include TNT_RDX_HMX_2.4-dintrobluene_2.6-dintrobluene	de TMT.	XOX HK	× 2.4 d	nitrotolue	ne. 26-d	Introtol	e e		
AT7.							AT17:					amino-4.	S-dinitrol	2-amino-4,6-dinitrotoluene, 4-amino,2,6-dinitrotoluene	amino,2.6	-dinitroto	neme						
ATB:							AT18:				۰, ا										ŀ		
AT9.							AT19:				  -'∾	SW-846 method 60108	sting 60	tota Metas (TAL) shall include alsento, beryllium, cadmium, chromum, ledu, mercury, zino by SW-846 method 60108	e arsenic	Deve	E Cadi	in chica	mum e	ad, mer	E S	ă.	
AT10:							AT20:				' I												
Analysis Suites:	÷.							Contrigencies:															l
Analysis Suite	#1: Moisture Co.	Analysis Suite #1: Moisture Content. Hydrogen for (pH), Cation Exchange Capacity. Barlinchamiens - Suite 1: Am. 241. Camma Start. During 11 to St. 00.	Cation Exch	ange Capac	Ą								ľ										F
	7 100 100 100	Section of the sectio	200																ŀ				ı
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Project Manager; HANEY, T. J./VANHORM, R. L.

SMO Contact: MCGRIFF, T. W.

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	s	Sample Description					Sample Location	cation			1		71.				17	OUT AD STATE OF A CAMPACATA STATE STATE CAMPACATA STATE OF A CTA CTA CTA				1	1		174	VIII V
Sampling	Запре	Sample	18 G	Sampling	Planned	brind.	Type of	Coaffon	Depth		<u> </u>	2 2		<u> </u>				2		2		-		+	1	
COTOS	2 0	S	_	9	OEM103	NEEL STATE	SI IBEACE SOIL	TRA	***	~-	_	$\neg$	-	_	_		+	┿	-	I	$\top$	+	╁	+	$\downarrow$	
ECT037	S 22	NOS NOS	SP SP SP SP SP SP SP SP SP SP SP SP SP S	J. J. W.	05/01/03	NEF	SURFACE SOIL	TRA	A.		+	+	+-	ļ-			╅╌	╁	<b>-</b>		$\top$	+	╁	-	$\downarrow$	
ECT038	REG	160\$	GRAB	COMP	05/01/03	INEEL	SURFACE SOIL	TRA	¥	-	+-	┼─	-	╀-			╁	╁	_			$\vdash$	$\vdash$		Ļ	
ECT039	REG	SOIL	GRAB	COMP	05/01/03	NEEL	SURFACE SOIL	TRA	AN.			-	_	_			_									
ECT040	REG	301	GRAB	COMP	05/01/03	NE	SURFACE SOIL	TRA	NA	-	-	├─	_				├					Н	-			
ECT041	REGIOC	108	DUP	COMP	05/01/03	MEE	SUBSURFACE SOIL	TRA	OB!	2			~	3											-	
ECT042	REG	NOS	GRAB	COMP	05/01/03	INEEL	SUBSURFACE SOIL	TRA	0 <u>9</u> L	-			-	-												
ЕСТОИЗ	REG	300	GRAB	COMP	05:01/03	INEEL	SUBSURFACE SOIL	TRA	T80	-		$\vdash$	1	-												
ECT044	REG	SOIL	GRAB	COMP	05/01/03	INEEL	SUBSURFACE SOIL	тва	OEF.	-	<del>                                     </del>		_	-			_				П	H	_	_		
ECT045	REG	301	GRAB	COMP	05/01/03	INEEL	SUBSURFACE SOIL	TRA	OBT	-		_	-	-								-		_	Ш	
ECT046	REG	108	GRAB	COMP	05/01/03	INEEL	SUBSIJRFACE SOIL	TRA	TBD	_		$\vdash$	_													
ECT047	REG	SOIL	GRAB	COMP	05/01/03	NEL	SUBSURFACE SOIL	TRA	180	-			,	+-				_								
ECT048	REG	1108	GRAB	COMP	05/01/03	INEEL	SUBSURFACE SOIL	TRA	TBD	-			-	+												
ECT049	REG	NOS	GRAB	arioo	05/01/03	INEEL	SUBSURFACE SOIL	TRA	DBD	-	-	Н	1	-			_	_				$\dashv$				
ECT050	REG	1IOS	GRAB	dWOO	05/01/03	INEEL	SUBSURFACE SOIL	JRA	T <b>B</b> D	-			-	-												
The sampling 4	activity displayed	he sampling activity displayed on this table represents the first six characters of the sample	e first six cha	racters of the	e sample identii	identification number.	The complete sample identification number (10 characters) will appear on field guidance forms and sample labels	number (10 characters) will appea	r on field guidance forms	and sa	ample (	spees														
AT1. Analys	Analysis Suite #1						ATH:					ი : 1	Comments:	ا افت	j	9		į	20							
ATZ GALDIN	Earthwarm Toxicity Test						AT12:					ات 1	Earthworld Loxicity Test by Ast in standard (1107/947)	Ě	59 60	2 E	M SCH	2000	76-0/0			}				ı
AT3. Nitroan	Nitrogramatics (8330)						AT13.					≃  	Rye Grass Test by ASTM standard E-1598-94 Seeding Growth Test	13 Test	Dy AST	St St	lard E.1	598-94	Seedin	5	Tes!		Н		U	П
AT4: Radioo	Radiochemistry - Suite						AT14:			ł		1								.					ļ	1
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SAP Number Date: 01/28/2003

Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONTORING FY-03

DRAFT

Project Manager: HANEY, T. J./VANHORN, R. L.

SMO Contact MCGRIFF, T.W.

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		Sample Description					Sample	Sample Location			ŀ	ļ	ŀ	<u>"</u>	oner Analy	Enter Analysis Types (AT) and Quantity Requested	(AT) and	Quamthy	Reques	2	ĺ			
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Project Manager: HANEY, T. J. WANHORN, R. L.

SMO Contact: MCGRIFF, T. W.

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Project LONG-TERM ECOLOGICAL MONITORING FY-03 Plan Table Revision; 0.0

DRAFT

Project Manager: HANEY, T. J WANHORN, R. L.

SMO Contact MCGRIFF, T. W.

Type of   Location   Location   City   Deptin   Location   City   Deptin   Location   City   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   Deptin   DEDINANCE AREA   NA   1   1   1   1   1   1   1   1   1	Type of   Location	Cate         Services         Annual         Income         Depte         Annual         Annual </th <th></th> <th>Sample Description</th> <th></th> <th></th> <th></th> <th></th> <th>Semple Location</th> <th>.ocadon</th> <th><b>I</b></th> <th>   -</th> <th></th> <th></th> <th>   -</th> <th>L</th> <th>  ₹  </th> <th>ysis Typ</th> <th>(A)</th> <th>and Quan</th> <th>Hitty Requ</th> <th>ested  </th> <th><b> </b></th> <th></th> <th></th> <th><math>\Box</math></th>		Sample Description					Semple Location	.ocadon	<b>I</b>	-			-	L	₹	ysis Typ	(A)	and Quan	Hitty Requ	ested	<b> </b>			$\Box$
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Project Manages: HANEY, T. J./VANHORN, R. L.

SMO Contact: MCGRIFF, T. W.

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Bate: 01/28/2003 Plan Table Revision

Plan Table Revision 0.0 Project LONG-TERM ECOLOGICAL MONITORING FY-03

. Project Manager: HANEY, T. J./MANHORN, R. L.

SMO Contact: MCGRIFF, T. W.

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ECX045	REG	SOIL	GRAB	COMP	05/01/03	INEEL	SUBSURFACE SOIL	ORDNANCE AREA	780	-	-	-	-				-	<u> </u>	<u> </u>	ļ		<u> </u>	
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ECX047	REG	SOIL	GRAB	СОМР	05/01/03	INEEL	SUBSURFACE SOIL	ORDNANCE AREA	TBD	-	-	_	F				<u> </u>						
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SAP Number: Date: 01/28/2003

Project LONG-TERM ECOLOGICAL MONITORING FY-03 Ptan Table Revasion: 0.0

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Project Manager HANEY, T. J. VANHORN, R. L.

SMO Contact. MCGRIFF, T. W.

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# Appendix B Sample Collection Procedures

## Appendix B

## Sample Collection Procedures

#### **B1. OVERVIEW**

Sampling for LTEM occurs as presented in the LTEM Plan (DOE-ID 2002b). Efforts are directed at sampling to determine levels of contamination in the selected media and to detect possible effects. Levels of contamination in soil, deer mice, and plants are determined to validate the OU 10-04 ERA assumption of no migration of contamination off the AOCs and to establish a baseline. Effects data are evaluated for soil fauna, plants, mammals, and avian receptors at the AOCs. This appendix presents the sampling procedures used to collect analytical and effects samples at each AOC.

- 1. Perform field plot selection for each of the three areas by randomly selecting ten plots in the site location grids (i.e., TRA, Ordnance Area #1, and reference area) designated for FY 2003 sampling
- 2. Prepare the plots by staking the corners and center, and distributing mammal traps in 3 m (10 ft) intervals on the  $100 \times 100$  m ( $110 \times 110$  yd) plot as shown in Figure B-1 and discussed in TPR-145

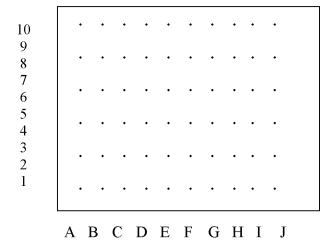


Figure B-1. Example of the transect design.

- 3. Obtain necessary paperwork, including safe work permits, scientific/trapping collection permits, and radiological work permits
- 4. Obtain all sampling equipment, forms, labels, etc. as required
- 5. Perform sampling in the spring and early summer of 2003:
  - a. During the first week:
    - (1) Perform soil sampling for plant and earthworm bioassays, analytical concentrations, and soil fauna community structure determination with the Berlese Funnel extraction procedure (the sampling procedure is presented in TPR-145)
    - (2) Perform plant tissue collection for analysis.

- b. During the second week:
  - (1) Perform sampling of small mammal community structure, presence/absence, diversity/richness, and density/biomass sampling using the trap and release methodology (the sampling procedure is presented in Section B3.1.3)
  - (2) Perform plant community structure, presence/absence, diversity/richness, and density/biomass sampling (the sampling procedure is presented in Section B3.1.1)
  - (3) Perform bird community structure, presence/absence, diversity/richness, and density/biomass sampling (the sampling procedure is presented in Section B3.1.2).
- c. During the third week:
  - (1) Perform deer mouse tissue sampling to obtain effects and analytical data
  - (2) Harvest small mammals for analytical concentration determination (the sampling procedure is presented in TPR-145)
  - (3) Harvest small mammal samples for organ to body weight measurements, histopathology, and genetic samples (the sampling procedure is presented in Section B3.4).
- 6. Perform decontamination of sampling equipment, task site, and personnel, as necessary
- 7. Prepare samples for storage and shipment to the appropriate facilities:
  - a. Genetic samples will be delivered to the geneticist
  - b. Histopathology specimens will be shipped to the laboratory
  - c. Preserved invertebrates will be sent to the laboratory
  - d. Bioassay soils will be shipped to the laboratory for plant and earthworm toxicity bioassays
  - e. Soil samples will be shipped to the laboratory for chemical and radiological analysis
  - f. Plant and small mammal samples will be frozen and shipped to the laboratory for chemical and radiological analysis.

## B2. ANALYTICAL SAMPLING PROCEDURES B2.1 Biota Analytical Samples

Samples of vegetation, mammals, and soil will be collected for analysis of contaminant concentration.

#### **B2.1.1 Vegetation Sampling Procedure for Analytical Sampling**

Two types of vegetation, shrubs and grasses, representing the two most common functional plant types at the INEEL will be collected for chemical analysis. A review of dietary information for herbivorous and omnivorous INEEL wildlife species has resulted in consideration of the following individual plant species and/or types:

- Wyoming big sagebrush (Artemisia tridentata)
- Crested wheatgrass (*Agropyron cristatum*).

Sagebrush represents the shrub most commonly utilized by the INEEL's primary consumers, including the pronghorn, sage grouse, black-tailed jackrabbit, Nuttall's cottontail, and the pygmy rabbit. In addition, sagebrush is an important component in the diets of avian and mammalian omnivores and herbivorous insects. Wheatgrasses are most widely used and are significant components in the diets of jackrabbits, cottontails, birds, and small mammals. If crested wheatgrass is not available or the amount is not sufficient, other wheatgrasses will be substituted.

Terrestrial vegetation samples will be collected during the early part of the growing season in conjunction with small mammal population analysis and tissue collection. Grass and sagebrush will be sampled in late May or June.

A field reconnaissance will be used to assess species presence and abundance within each randomly selected  $100 \times 100$  m ( $110 \times 110$  yd) grid. If wheatgrass or sagebrush is unavailable, the nearest grid that contains a sufficient amount of these species will be evaluated. A field reconnaissance of potential reference areas will also be completed to match the reference area with the site areas to the greatest extent possible. Potential reference sampling areas with soil types similar to those onsite that have not been recently burned were identified in Figure 1-3. Final selection of the reference area and sampling grid cells will be based on the presence of suitable species and access.

Each vegetation tissue sample will be a composite of material from at least five individual plants of the same species. Individual plants should be randomly selected within a 20-m (22-yd) radial plot in each corner and center of the  $100 \times 100$  m ( $110 \times 110$  yd) grid. Such plants should also located at least 1 to 3 m (1.1 to 3.3 yd) apart, depending on size. Atypical individuals (i.e., resembles less than 5% of the plants for the area) based on size or herbivory should not be included. An approximately equal amount of vegetation should be collected from each individual plant.

Clean disposable gloves should be worn. Plant samples should be clipped with pruning shears or grass shears, as appropriate. Plant material from each of the five radial plots should be combined into one plastic bag to make a composite sample. Sagebrush should be clipped on at least two sides and at two different heights to obtain a representative sample.

A minimum of 60 g of fresh biomass is required for radiological and metal analysis. If munitions analyses are required, an additional 30 g per analyte group is needed. Sample weight should be verified in the field to ensure an adequate quantity has been collected. Plant samples should be placed into a sealable plastic bag that has been placed into another sealable plastic bag. Sharp points on woody vegetation should be bent or broken off within the bag to avoid bag puncture. Bags should be labeled and the field data should be recorded in notebooks or on field data sheets. Samples should be placed in a cooler on ice until it is frozen or shipped to the laboratory. Field data will be recorded.

Grass samples should be collected by clipping above ground level (e.g., 1.3 to 5.1 cm [0.5 to 2 in.]) with grass shears. Clipping should be adjusted, as needed, to minimize sampling dead vegetation from previous years and to maximize sampling green vegetation from the current growing season. All material above the cutting height will be collected. Dead material should be removed from the sample by hand if unavoidably collected. Grass samples will include new growth of leaves, stems, and any inflorescences present on the plants. It is desirable to remove as much dead material as possible; however, this may be impractical and an estimate of the percentage of dead material should be noted.

Shrub samples should be collected using pruning shears. Collected material will include leaf and stem growth from the current season. Shrubs should be clipped at a height between 0.5 to 1.5 m (0.55 to 1.6 yd) on at least two sides. It is common to also collect woody material during this process. Stripping fresh leaves and stems from the woody material may be necessary. In the event that woody material is not removed, the sampler should make an estimate of the remaining amount.

Macrophytic aquatic plants should be collected along the margins of the wastewater ponds and the Big Lost River Sinks. One composite sample will be collected at each aquatic sample location. The aboveground portion of each plant should be cut and placed in a labeled heavy-duty plastic bag, then placed in a cooler with ice for transport to the analytical laboratory.

Modifications to these procedures can be made in the field as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets. Soil samples collocated with the plant tissue samples (i.e., from within the center of each 20-m [22-yd] radial plot in each corner and within the center of the  $100 \times 100$  m [ $110 \times 110$  yd] grid) will also be collected.

#### **B2.1.2 Mammal Sampling Procedure for Analytical Sampling**

One small mammal species, the deer mouse (*Peromyscus maniculatus*), representing the major links between primary and secondary consumers and higher predators, will be collected for tissue analyses. The deer mouse is a primary prey item for both secondary and tertiary consumers. This species is commonly used to represent several important linkages in the food chain and is the primary choice because it is omnivorous, widespread, and relatively easy to collect.

Collection of animal samples will be in accordance with applicable sections of TPR-145 and in accordance to the following information discussed. Deer mice will be collected for tissue analysis. It will be necessary to collect several deer mice for each analysis to obtain the 60 g of tissue required. Deer mice will be composited to obtain the required tissue amounts. Compositing will not include segregation of small mammals by sex or age, but will be limited to the single species. Small mammal species, other than deer mice, will be weighed, photographed, and have other life history or details recorded in the field logbook and released.

The deer mouse samples will not be washed before homogenization. The intent of this sample preparation is to evaluate what a predator is most likely to consume. By incorporating all unwashed biotic tissue, all available contaminants in each sample will be assessed; however, not all of the analytes are necessarily bioavailable.

The same trapping design (see Section B3.1.3) used to evaluate small mammal population/community data will be used to collect deer mouse tissue samples for analytical assessment. Ten trapping locations or sample plots will be used in the two AOCs (Ordnance Area Group #1 [including the Experimental Field Station, Fire Station II Range Fire Burn Area, and NOAA Grid] and TRA) and the reference area. A  $100 \times 100$  m ( $110 \times 110$  yd) grid was placed over each of these areas, and plots were

randomly chosen at each location. Figures 3-1 through 3-3 show the location of all ten sample plots at each of the three areas. Each sample plot will require a two-week to three-week trapping period and will consist of one hundred traps placed along ten parallel transect lines (ten traps on each). Each of the transects will follow a roughly straight line 100 m long. An example of the transect design is shown in Figure B-1.

Traps will be left open four nights, closed three nights, and then reopened an additional four nights. Once an animal is trapped, a unique numbered ear tag is attached. The ear tag correlates with the trap location, genus, species, collector's initials, and date recorded in a field logbook. The animal should be emptied into a plastic bag. It should be sexed, aged (adult/juvenile), weighed, and identified to its species if possible. A ruler should be used to measure the head-body length, ear from skull to tip, tail, and right hind foot to the nearest millimeter. The animal should then be returned for release to the location it was trapped. All information should be recorded on the data sheet.

Tissues will be collected for chemical and radiological analysis, genetics, and histopathology. On the last day of the population surveys, at least three deer mice in each grid will be retained as a single composite sample. Animals to be sacrificed for contaminant analysis will be dispatched in the field by asphyxiation with carbon dioxide. After dispatch, each carcass will be weighed and placed within another clean plastic bag. The amount of sample material in the composite sample will be determined by summing the weights of the individual specimens from each location. Processing should take place as soon as possible after checking traps to reduce potential degradation of the specimen. Samples will be placed on ice for transport to the processing center.

Portions of each animal's liver and kidney will be collected for histopathology. A ventral incision will be made with a clean scalpel blade. Small sections of the liver and kidney will be removed, weighed to the nearest 0.01 g, and placed in a 10% buffered Formalin. This solution is potentially carcinogenic and should be handled with caution that is detailed on the respective material safety data sheets (MSDS). The jar will be labeled with appropriate sample information (i.e., time, date, and sample identification number). Small sections of maternal and fetal tissue will be removed from female mice. The carcasses will be placed in a sealable plastic bag and placed inside another bag with the sample labeled. COC forms will be filled out.

Tissue samples for residue analysis should be frozen and shipped on blue ice to the laboratory. Dry ice can cause serious skin burns if handled incorrectly. Gloves should be worn when handling dry ice.

A single voucher specimen will be photographed, but will not be analyzed for contaminants. An experienced wildlife biologist will examine the voucher specimen to verify genus and species.

## **B2.2 Soil Analytical Characterization**

Soil samples will be collected from the surface 0 to 5 cm (0 to 2 in.) and subsurface 5 to 61 cm (2 to 24 in.) or bedrock (i.e., limited to two sampling intervals), and will consist of composites from locations within the sampling plot designs that correspond to plants from which vegetation samples are collected.

Before sampling, it is important to calculate the total volume of sample material that each increment sample location will collect to ensure that the volume required for each analysis is available, to completely fill each sample container. The analysis-specific volumes are specified in Table 4-4. Sampling locations specified in the Figures 1-3 and 3-1 through 3-3 will be identified and marked using surveying stakes, lath, or flags. The soil will be evaluated for contamination concentrations.

#### **B2.2.1 Surface Soil Material**

Composite surface material samples will be comprised of five increment subsamples collected from each of the corners and center point of a 100-m (110-yd) square. All or a portion of the increment samples are mixed together to create a composite sample representative of average constituent concentrations within the area to be characterized. For a given composite sample, the volume of each increment sample must be the same, and must equal 1/n of the required composite sample volume, where n equals the number of increment samples making up the composite sample.

Surface material samples are collected as follows:

- 1. At each subsample location, an area approximately 61 cm (24 in.) in diameter is cleared of surface vegetation, nondecomposed plant litter, and debris.
- 2. A decontaminated stainless steel spoon or hand auger is used to collect surface material to a depth of five centimeters. A stainless steel pick may be used as needed to loosen the soil. To the extent possible, gravel-size or larger particles and debris are eliminated, based on visual observation.
- 3. The material is described visually and observations are recorded on the soil sample field data sheet.
- 4. The increment sample is sieved through a No. 10 mesh and the fine fraction placed into a decontaminated stainless steel mixing bowl; then thoroughly mixed.
- 5. For composite samples, Steps 1 through 4 are repeated at each increment sample location that composite sample adding each successive increment sample to the mixing bowl.
- 6. The sample material is thoroughly mixed in the stainless steel bowl using a decontaminated stainless steel spoon. To homogenize, the sample is divided into four quarters and mixed, then the four quarters are combined and the entire sample mixed. The mixture is placed into the appropriate laboratory-supplied sample containers.
- 7. The containers are labeled and handled as required. Soil subsample location descriptions and collection information will be documented in the logbook per MCP-1194.

#### **B2.2.2 Subsurface Soil Material**

Subsurface material samples are collected as composite samples. Before sampling, it is important to calculate the total volume of collected sample material at each increment sample location to ensure the volume required for each analysis is available to completely fill each sample container. The analysis-specific volumes are specified in Table 4-4. Specified sampling locations will be identified and marked using surveying stakes, lath, or flags.

Composite surface material samples will be comprised of five increment subsamples collected from each of the corners and center point of a 100-m (110-yd) square. All, or a portion of, the increment samples are mixed together to create a composite sample representative of average constituent concentrations within the area to be characterized. For a given composite sample, the volume of each increment sample must be the same, and must equal 1/n of the required composite sample volume, where n equals the number of increment samples making up the composite sample.

Subsurface material samples are collected as follows:

- 1. At each sample location, an area approximately 61 cm (24 in.) in diameter is cleared of surface vegetation (nondecomposed plant litter) and debris.
- 2. A decontaminated stainless steel spoon or hand auger is used to collect subsurface material from a depth of 5 to 61 cm (5 to 24 in.) below ground surface (decontaminated per TPR-6575). A stainless steel pick may be used as needed to loosen the soil. To the extent possible, gravel-size or larger particles and debris are eliminated based on visual observation.
- 3. The material is visually described and observations recorded on the soil sample field data sheet.
- 4. The increment sample is sieved through a No. 10 mesh and the fine fraction placed into a decontaminated stainless steel mixing bowl; then thoroughly mixed.
- 5. For composite samples, Steps 1 through 4 are repeated at each increment sample location for that composite sample, adding each successive increment sample to the mixing bowl.
- 6. The sample material is thoroughly mixed in the stainless steel bowl using a decontaminated stainless steel spoon. To homogenize, the sample is divided into four quarters and each quarter is mixed, then the four quarters are combined and the entire sample is mixed. The mixture is placed into the appropriate laboratory-supplied sample containers.
- 7. The containers are labeled and handled as required. Soil subsample location descriptions and collection information will be documented in the logbook per MCP-1194.

The center of the sample grid location will be surveyed using a GPS unit.

## **B2.3 Soil Nutrient and Physical Characterization**

Soil samples for soil nutrient and physical characterization will be collected at the same time and same locations as soil samples for contaminant analysis. Each composite sample will be collected as follows:

- Soil sampling sites will be collocated with chemical and radiological soil samples.
- Following collection of the chemical analysis samples (described above), appropriate amounts of homogenized soil will be placed into the shipping containers for analysis. Approximately 500 g will be placed into a sealable plastic bag for soil nutrient and physical characterization.
- The containers will be labeled and handled as specified by the FSP.

Modifications to these procedures may be made in the field, as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

#### **B3. EFFECTS SAMPLING**

## **B3.1 Population/Community Data**

Ecological systems such as populations or communities are usually quite large and complex. These systems must be described and quantified to compare them with one another or assess changes in them. Several ecological variables can be measured, such as density, frequency, coverage, and biomass, to describe populations and communities. These measurements are used to characterize aspects of populations and communities such as presence/absence, population density, population distribution, species diversity, and productivity (biomass).

#### **B3.1.1 Vegetation**

A number of sampling technique designs are available for sampling plant populations and communities such as a census, quadrant, transects, and line-intercept. The two types of vegetation surveys that will be used to characterize the plant populations during the 2003 sampling events at Ordnance Group #1, TRA, and the reference area are the Daubenmire method and the line-intercept method. Both methods are suitable for estimating the cover for small shrubs, rhizomatous grasses, and bunchgrasses.

**B3.1.1.1 Daubenmire Method.** The Daubenmire method begins with the establishment of transect lines 30.5 m (100 ft) in length, randomly placed at each location. If possible, transects will be established at least 100 m (300 ft) from ecotones, roads, and other anthropogenic influences. GPS positions will be recorded and logged for the start and end points on each transect. Each transect line will have ten quadrat locations (or sample plots) spaced 3 m (10 ft) apart. A  $1 \times 3 \text{ m}$  ( $1.1 \times 3.3 \text{ yd}$ ) quadrat will be used to estimate percent ground cover. As the quadrat frame is placed along the tape at the specified intervals, the canopy coverage of each plant species is estimated. In addition the data is recorded by quadrat, by species, and by cover class. Canopy coverage estimates can be made for both perennial and annual plant species.

- 1. The quadrat frame is observed directly from above and the cover class for all individuals of a plant species in the quadrat is estimated as a unit. All other kinds of plants are ignored as each plant species is considered separately.
- 2. A line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescence) is imagined and these polygonal images are projected onto the ground. This projection is considered "canopy coverage." The classes the canopy coverage of the species falls into can be determined (see Table B-1).
- 3. Canopies extending over the quadrat are estimated even if the plants are not rooted in the quadrat.
- 4. The data are collected during a period of maximum growth for key species.
- 5. For tiny annuals, it is helpful to estimate the number of individuals that would be required to fill 5% of the frame. A quick estimate of individuals in each frame will then provide an estimate as to whether the aggregate coverage falls in Class I or II, etc.
- 6. Overlapping canopy cover is included in the cover estimates by species; therefore, total cover may exceed 100%. Total cover may not reflect actual ground cover.

Table B-1. Plant cover classes.

Coverage Class	Range of Coverage (%)	Midpoint of Range (%)
1	0 to 5	2.5
2	6 to 25	15.0
3	26 to 50	37.5
4	51 to 75	62.5
5	76 to 95	85.0
6	95 to 100	97.5

While using this method, it is important to keep track of the growth, form of each species so that comparisons of grass vs. forb vs. shrub can be made. Also, if it is present, an estimation of the cover of bare ground and rocks will provide additional characterization data. While conducting this survey, it is important to remember to record total cover for each quadrat because this may differ from the sum of the cover values for individual species (due to plant canopy overlap). The surveyor should have a cover category for each quadrat among all identifiable species, mosses (if any), bare ground, rocks, and total cover.

Once the surveys are complete, the species cover can be estimated by multiplying the number of times a class is recorded by the midpoint of that cover class, adding the results for each class, and calculating an average by dividing by the total number of quadrats sampled. Data are usually collected from many quadrats located along a transect, so that the transect is the sample unit. Therefore, data must be collected from several transects to determine the sample's precision for statistical analysis of cover data.

This method recognizes the difficulty in accurately assigning an exact percent cover value to each quadrat, since even the ability of highly experienced workers are unlikely to visually estimate closer than about 5% cover. Assigning broad cover classes provides an equally accurate result as long as the data follows a normal distribution around the midpoint within each class. The narrower upper and lower classes of the Daubenmire scale protect against skewed data in extremely sparse or dense vegetation.

Ranking data into broad classes is also a relatively rapid procedure, since observers are not required to spend as much time contemplating quadrat cover to the nearest percent. In fact, rapid evaluation of each quadrat is the key to success with this approach, since a large sample is less sensitive to the occasional incorrect ranking.

**B3.1.1.2 Line-Intercept Method.** The second method, line-intercept, uses a measuring tape (or marked string) stretched between two stakes or points (a transect line). The tape is pulled taunt and is anchored at both ends. The intercept distance is recorded for each plant/species that intercepts the line. Shrub cover is determined by tallying the measurements at which the line passes over or under the edges of individual plants (USFWS 1981). Surveyors move along the line and project the plant canopies vertically to the tape. The surveyors also record the length of the line segment intercepted by the plant and the type of plant involved. The vertical projection extends from the ground to infinity. As a result, it should be ensured that shrub cover intercepting above and below the line is recorded. Generally, small gaps between shrub foliage/branches (user defined) are ignored and included in shrub intercept measurements.

If different plant species overlap, each is measured separately; however, cover projections are not doubled (this is done to document shrub species diversity). If desired, shrub intercept can be recorded within different height strata (i.e., low, medium, tall, etc.).

Cover is calculated by adding all intercept distances and expressing this total as a proportion of tape length. Each transect is regarded as one sample unit, so multiple transects must be measured to estimate sample variance and conduct statistical analyses of cover data. For example, 10 ft of cover/  $100 \text{ ft} \times (100) = 10\%$  shrub cover (Figure B-2). Percent cover for the entire transect is determined by adding the percent cover of each 100 ft sample unit, then dividing the sum by the transect length (i.e., 120 ft of cover/ $1000 \times [100] = 12\%$  cover).

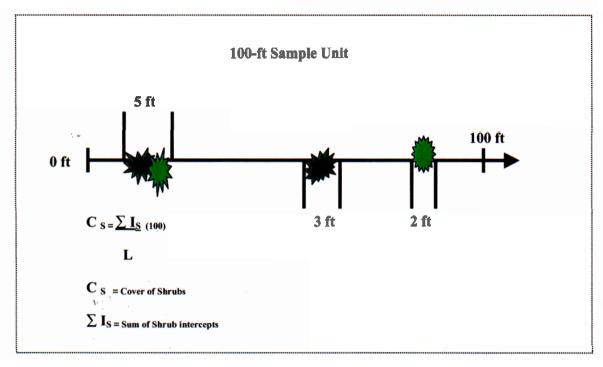


Figure B-2. Shrub cover intercept example.

The line-intercept method is easy to learn, simple to use, and provides an accurate estimate of cover. In fact, line-intercept sampling is often used as the standard comparison when testing other methods to determine cover. Its primary drawback is that sampling can be time consuming, particularly in dense vegetation or when intercept distances are difficult to define because of many gaps or irregular edges within the canopy. Therefore, the line-intercept technique is best suited for vegetation characterized by discrete plants, such as bunchgrasses or compact shrubs.

#### **B3.1.2 Birds**

The Breeding Bird Survey is a roadside survey of avifauna designed to monitor abundance and distribution of birds in the United States and southern Canada. Routes have been established and used at the INEEL (Belthoff and Ellsworth 1999). The methodology used in this FSP will be adapted to the sampling presented in Belthoff and Ellsworth (1999). Additional evaluation of bird population/community data will be incorporated as a selected study in an area of known contamination.

#### **B3.1.3 Mammals**

Small mammals will be evaluated by using live trapping methods. The ten sample plots established for biota and soil analytical sampling will be used to assess the small mammal population/community data in the two AOCs (Ordnance Area Group #1 [including the Experimental Field Station, Fire Station II

Range Fire Burn Area, and NOAA Grid] and TRA) and the reference area. Figures 1-3 and 3-1 through 3-3 show the location of all sample plots at all three areas. Each sample plot will require a two to three-week trapping period, and will consist of one hundred traps placed along ten transect lines (ten traps on each) in a line grid formation. Each of the transects will approximately follow a 100 m long straight line. An example of the transect design is shown in Figure B-1.

Traps will be left open four nights, closed three nights, and then reopened an additional four nights. There will be 800 nights of trapping within each 100 m sample plot during the 2003 trapping season. Statistical evaluation of the initial data may be used to alter this design.

Once an animal is trapped, a unique numbered ear tag is attached. The ear tag correlates with the trap location, genus, species, collector's initials, and date recorded in a field logbook. The animal should be emptied into a plastic bag. It should be sexed, aged (adult/juvenile), weighed, and identified to its species if possible. A ruler should be used to measure the head-body length, ear from skull to tip, tail, and right hind foot to the nearest millimeter (mm). The animal should then be released to the original location from where it was trapped. All information should be recorded on the data sheet.

The mark-and-recapture method will be used in estimating population densities. This method involves several steps:

- 1. Trapping and marking some individuals of a population
- 2. Releasing the known number of marked individuals back into the population from which they were captured
- 3. Trapping some individuals of the population after the marked individuals have had a chance to redistribute themselves into the population
- 4. Estimating the total population size by a series of computations that are based on the ratio of marked to unmarked individuals in the recapture attempt.

Generally speaking, if the population is large, the marked individuals will become diluted within it and only a few would be expected to appear in the second sample. If assumptions about the sampling and animals' distribution are correct, then the proportion of marked individuals in the second sample is the same as the entire population.

Like all estimation procedures, a number of assumptions must be met to validly use this method:

- The two samples taken from the population must be random samples (i.e., all individuals in the population have an equal and independent chance of being captured during the time of sampling).
- There is no change in the ratio of marked to unmarked animals, meaning that from initial capture to recapture there must be no significant addition of unmarked animals to the population through births or immigration.
- The population losses from mortality and emigration must remove the same proportion of marked and unmarked individuals.
- The marking of individuals does not affect their mortality.
- Individuals do not lose marks.

The Peterson-Lincoln Index, the simplest method for determining the population size, will be used. The total population may be estimated as follows:

- Assume the total estimated population size contains N individuals
- Sample M individuals from this population, mark these animals, and return them to the population
- Sample a second set of n individuals from the population; this sample contains recaptured animals (i.e., individuals captured and marked in the first sampling)
- Estimate the population size, N, by the equation:

$$N = Mn/R \tag{1}$$

Equation 1 may overestimate the population size (i.e., it is biased) when samples are relatively small. No is a nearly unbiased estimate of population size if the number of recaptured animals, R, is at least eight. This bias can be reduced by computing:

$$Nc = \frac{(M+1)(n+1)-1}{R-1}$$
 (2)

The approximate variance, s<sup>2</sup>, of this estimate is:

$$s^{2} = \frac{(M-1)(n+1)(M-R)(n-R)}{(R+1)^{2}(R+2)}$$
(3)

With the standard deviation, s, 95% and 99% confidence limits on the population estimate are given by:

$$N(or NC) + 1.96(s)(95\% confidence limits)$$
(4)

and

$$N(or\ NC) + 2.58(s)(99\%\ confidence\ limits) \tag{5}$$

#### **B3.1.4 Reptiles**

Collection of small mammals will provide an indication of possible exposure of reptiles to contamination in the soil. Population information will be collected for these receptors that is consistent with the direction in the OU 10-04 ROD. Collection will occur during future field seasons under the LTEM Plan and will use university experts in the design of the project.

## **B3.2 Earthworm and Plant Bioassay Soil Samples**

Bioassay soil samples will be collected at the same time and same locations as soil samples. Each composite sample will be collected as follows:

Soil sampling sites will be collocated with chemical and radiological soil samples.

- Following the collection of the chemical analysis samples (described above), appropriate amounts of homogenized soil will be placed into the shipping containers for the bioassays.
- Containers will be labeled with the date, location, and other appropriate information and shipped on ice to the bioassay laboratory for processing.

Modifications to these procedures may be made in the field as appropriate based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

## **B3.3 Soil Invertebrate Community Survey Soil Samples**

Soil samples for soil on invertebrate community structure will be collected at the same time and same locations as soil samples for analysis. Each composite sample will be collected as follows:

- 1. Soil sampling sites will be collocated with the chemical and radiological soil samples.
- 2. Following collection of the samples for chemical analysis, appropriate amounts of homogenized soil will be placed into shipping containers for the Berlese Funnel extraction. Approximately 500 g of soil will be placed into a sealable plastic bag for Berlese Funnel extraction to conduct soil fauna community analysis.
- 3. Large invertebrates will be removed from the soil sample.
- 4. The soil sample is placed in a funnel under a 40-watt light bulb. The lamp above the soil creates a warm, dry, and well illuminated condition at the top of the funnel, encouraging cool-, shade-, and moisture-loving invertebrates to move down the funnel into a collecting bottle containing a preservative (i.e., 80% ethanol).
- 5. The Berlese Funnel technique gives a biased sample of soil fauna because it captures species that are mobile and do not desiccate easily. Therefore, the Burlese Funnel it may miss many insect larvae and other soft-bodied invertebrates.
- 6. The containers will be handled and labeled with the date, sample location, and other information as appropriate.

Modifications to these procedures may be made in the field as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

## B3.4 Histopathology and Body and Organ Weight

Small mammal tissues will be collected for chemical and radiological analysis, genetics, and histopathology. On the last day of small mammal population surveys (see Section B3.1.3), at least three deer mice in each sampling plot will be retained as a single composite sample. Deer mice will be taken to the laboratory and humanely killed. Immediately before processing, live animals should be killed by cervical dislocation or asphyxiation with carbon dioxide gas. Animals should be removed from traps one at a time, so that specimens are not misidentified. Processing should take place after trap checks as soon as possible to reduce potential degradation of the specimen. The deer mice will be weighed to the nearest 0.1 g.

A ventral incision will be made with a clean scalpel blade. Small sections of liver and kidney will be removed for histopathology and weighed to the nearest 0.01 g, then placed in 10% buffered Formalin. This solution is potentially carcinogenic and should be handled with caution as detailed on the MSDS. The jar will be labeled with appropriate sample information (time, date, sample identification number, and ear tag number).

Small sections of maternal and fetal tissue will be removed from female mice for genetics analysis. The three carcasses forming the single composite sample will be placed in a sealable plastic bag, placed inside another bag, and then labeled for contaminant analysis. COC forms will be filled out.

The removal of the kidney and liver may reduce apparent concentrations slightly. Estimate loss in concentration are as follows:

```
mg/kg WB * kg WB + mg/kg L * kg L + mg/kg k kg k

mg/kg WB = concentration in whole body

mg/kg L = concentration in liver (estimated)

mg/kg k = concentration in kidney (estimated)
```

A bioaccumulation factor from the literature will be used to estimate the fraction lost to histopathology. Although the bioaccumulation factor introduces uncertainty into the assessment, the liver and kidney tend to concentrate metals and may exhibit cellular changes for evaluation of effects from exposure. If effects are determined to be present, a selected study will be performed to further characterize this problem or the sampling approach will be modified appropriately.

### **B4. AQUATIC ECOSYSTEM CHARACTERIZATION**

Aquatic ecosystem sampling will be performed across the INEEL at AOCs during future sampling seasons as discussed in the LTEM Plan (INEEL 2003). This approach will allow optimization of sampling efforts and should reduce analysis costs.

## **B4.1 Sediment and Surface Water Analytical Sampling**

Sediment and surface water samples will be obtained from the reference area and from the waste ponds at TRA and will be used to predict health effects and exposure in selected collocated species and swallows.